Organizing for Flexibility: Addressing Dynamic Capabilities and Organization Design

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Chapter 7
Organizing for Flexibility: Addressing Dynamic Capabilities and Organization Design

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7.1 Introduction

This chapter addresses the organizational design and information processing challenges of individual firms operating in a dynamic environment – such as a collaborative community of firms – from a perspective of organizational flexibility.

The concept of organizational flexibility has received wide attention in the management literature in recent decades. Broadly defined, organizational flexibility reflects the capacity of an organization to respond to various kinds of external change (Volberda 1998). With increasing levels of turbulence documented in the business environment (Wiggins and Ruefli 2005) and the speed with which competitive advantages are nullified in some markets (D'Aveni 1994), the need for flexibility is increasingly apparent. Management literature stresses the complex nature and multifaceted structure of organizational flexibility (e.g., Volberda 1996; Teece et al. 1997; De Toni and Tonchia 2005).

Table 7.1 presents an overview of recent empirical studies that take a multidimensional approach to flexibility. Notwithstanding their merit in identifying relevant dimensions of organizational flexibility, many of these and other studies of organizational flexibility neither account for such complexity nor address the interrelated dimensions of *both* managerial capabilities and organization design variables (Dreyer and Grønhaug 2004). Thus, despite the attention paid to organizational flexibility in

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Table 7.1 Empirical studies applying multidimensional conceptualizations of organizational flexibility

Authors	Dimensions	Sample	Outcomes
Eppink (1978)	Operational, competitive, and strategic flexibility	Three firms (exploratory interviews)	Suggests multi-dimensionality and hierarchical nature
Fiegenbaum and Karnani (1991)	Operational flexibility	>3,000 companies	Variation of output over time in response to changing market conditions
Sanchez (1995)	Coordination flexibility and resource flexibility	Anecdotal	Suggests high-level multi-dimensionality (managerial and organizational flexibility)
Volberda (1996/1998)	Steady-state, operational, structural, and strategic flexibility responsiveness of technology, structure, and culture	Three large Dutch firms (case studies)	Confirms hierarchical nature and multi-dimensionality of construct
Anand and Ward (2004)	Mobility flexibility (alter production), range flexibility (product/process diversity)	101 manufacturing firms	Confirms multi-dimensionality at first-order level
Dreyer and Grønhaug (2004)	Volume flexibility, product flexibility, labor flexibility, financial flexibility	35 failures and 35 successful firms	Confirms existence of different types of flexibility
Sanchez (2004)	Five modes of competences reflecting specific forms of flexibility	Conceptual	Suggests hierarchical nature of capabilities
Verdu Jover et al. (2005)	Operational flexibility, structural flexibility, strategic flexibility	417 European firms	Confirms existence of different types of flexibility
Hatum and Pettigrew (2006)	Centralization and formalization institutional embeddedness environmental scanning organizational identity	Two highly flexible and two less-flexible firms	Confirms multi-dimensionality of organization design construct
Nadkarni and Narayanan (2007)	Strategic flexibility	225 firms	Validates four measures of strategic flexibility

the literature, there remains a need to specify and empirically validate the complete set of relations between the different dimensions of organizational flexibility, to mitigate the risks of drawing partial or even false conclusions from underspecified single-dimension models.

These risks are not just hypothetical. For example, management literature is inconclusive on the effects of firm size on organizational flexibility (Kraatz and Zajac 2001; Bercovitz and Mitchell 2007). Such inconclusiveness may be due to differences in the way organizational flexibility is conceptualized; different perspectives may reveal different kinds of relationships between firm size and various constructs. Whereas firm size may have negative effects on some aspects of flexibility, e.g., increasing inertia, large size also increases financial slack and the variety of routines and external ties. Failing to incorporate these different perspectives may result in underspecified models and false rejection of null-hypotheses (Type I errors), or inconclusive results at best. Furthermore, Type II errors may occur when variety between organization stems from factors omitted from an underspecified model. Omitting relevant variables in an organizational fit analysis, for example, may cause false conclusions with respect to similarities between organizations which in fact differ in essential but overlooked aspects.

To deepen our understanding of the relationships between different dimensions of the organizational flexibility construct, we set out to create a framework (or nomological network, cf. Cronbach and Meehl 1955) consisting of the concepts of interest, the observable manifestations, and the interrelationships among them. The framework aims to clarify the meaning and validity of constructs and specifies laws (nomologicals) that link theoretical constructs to each other and to observables. Such a framework may facilitate researchers to further develop and test theories on this increasingly important management construct and may help managers to effectively develop flexibility in their organizations.

In this chapter, we develop and assess the empirical validity of a nomological net that portrays the causal components of organizational flexibility. First, we define the central constructs and present a number of assertions from previous academic works that explain relationships between these components. We use these to build a multidimensional, hierarchical framework of organizational flexibility. We then describe how empirical measures of organizational flexibility were developed and tested, and how the hierarchical model was tested, against a large sample of 3,259 firms of various size classes across 15 industries. Section 7.3 confronts the theoretical framework with observable manifestations of organizational flexibility and demonstrates overall support for the nomologicals specified in our statistical model. Having established the validity of the conceptual relationships, we discuss how our findings may inform the theory and practice of organization design.

7.2 Theory Development

The concept of organizational flexibility has been studied in management literature for several decades (see reviews by Volberda 1998 and Johnson et al. 2003). Nearly all definitions of organizational flexibility emphasize the adaptive capacity of management in terms of an ability (Aaker and Mascarenhas 1984), a repertoire (Weick 1982), a degree of freedom (Sanchez 1995), or free options (Quinn 1985) to initiate or adapt to competitive change (Volberda 1996, p. 360).

Our framework draws on systems theory of control, or cybernetics (De Leeuw and Volberda 1996; Volberda 1998), to portray organizational flexibility as the outcome of an interaction between (a) the dynamic control capacity of management and (b) the controllability or responsiveness of the organization. This interaction is such that the elements must be in balance. If one outweighs the other, there is no gain. More controllability does not compensate for less capacity. The system is only as effective as the weakest dimension. Hence, flexibility is a function of the interaction of two sets of variables. We can see this duality in two separate tasks. First, flexibility is perceived to be a managerial task. Can managers respond at the right time in the right way? In this connection, the concern is with the dynamic managerial capabilities that endow the firms with flexibility; for example, manufacturing flexibility to expand the number of products the firm can profitably offer to the market, or innovation flexibility to reduce the response time for bringing new products to the market. Second, flexibility is perceived to be an organization design task. Can the organization react at the right time in the directed way? The concern here is with the controllability or changeability of the organization, which depends on the existence of the right organizational design to foster flexibility. For example, manufacturing flexibility requires a technology with multipurpose machinery, universal equipment, and an extensive operational production repertoire (cf. Adler 1988). Similarly, innovation flexibility requires a structure of multifunctional teams, few hierarchical levels, and few process regulations (cf. Quinn 1985; Schroeder et al. 1986).

7.2.1 The Managerial Task: Developing Dynamic Capabilities

As a managerial task, achieving flexibility involves the creation or promotion of dynamic capabilities, which are here taken to mean capabilities that purposefully create, extend, or modify a firm's resource base or ordinary routines (cf. Helfat et al. 2007; Huber 2011; Volberda 2003; Winter 2003). Such dynamic capabilities increase management's control capacity in general.

The number of dynamic capabilities, the variety within the repertoire of capabilities, and the rapidity with which management can deploy capabilities determine the extensiveness of management's control capacity. A repertoire that is limited to ordinary routines actually provides no capacity to adapt at all, i.e., it provides "steady state flexibility" (Volberda 1996).

The repertoire may also include capabilities that create first-order change, i.e., change in the throughput levels of ordinary routines. Such capabilities are based on present structures and goals of the organization and result in a capacity to change the volume and mix of activities, i.e., result in "operational flexibility" (Volberda 1996;

Zollo and Winter 2002). Operational flexibility provides rapid response to changes that are familiar and typically leads to temporary fluctuations in the firm's activity. The objective of operational flexibility is to maximize efficiency and minimize risk in a volatile market.

The set of dynamic capabilities may also create even higher-order change, which reflect management's ability to reconfigure the firm's resource set more fundamentally, adapt the organizational structure, or even change the nature of organizational activities (Winter 2003; Helfat et al. 2007). Higher order capabilities can be oriented at the administrative framework or at the resources and competences of the firm (Winter 2003). Change routines oriented at the administrative framework of a firm, i.e., the organizational structure and its decision-making and communication routines, provide "structural flexibility" (Volberda 1998). Structural flexibility consists of managerial capabilities to adapt the organizational structure, and its decision and communication processes, to suit changing conditions in an evolutionary way (Krijnen 1979).

Higher order capabilities can also be oriented at changing the nature of activities and the goals of the organization (Aaker and Mascarenhas 1984). Such capabilities provide "strategic flexibility," where this term is here taken to include a broad variety of dynamic capabilities, for example, creating new product market combinations (cf. Krijnen 1979), dismantling current strategies (cf. Harrigan 1985), using market power to deter entry and control competitors (cf. Porter 1980), the ability to shift or replicate core manufacturing technologies (cf. Galbraith 1990), and the capability to switch gears relatively quickly and with minimal resources (cf. Hayes and Pisano 1994). These examples indicate that strategic flexibility stems from those capabilities that provide a variety of strategic options that can be implemented at relatively high speed.

7.2.2 *The Organization Design Task: Creating Adequate Organizational Conditions*

Management's control capacity is affected by organizational conditions to provide adequate leeway for change, i.e., the controllability of the organization. Deploying managerial dynamic capabilities often poses strong demands on the organizational foundations (Volberda 1996; Teece 2007), as capabilities can be utilized efficiently only if supported by an appropriate organizational design (Grant 1996).

The concern here is with the requisite conditions to foster flexibility, as organizational design affects the *potential* for various flexibility types. The ability to deploy dynamic capabilities depends on the design adequacy of the organizational conditions (Zelenovic 1982). Previous academic work explains the relationships between different types of flexibility and individual organization design characteristics such as the organization's technology, structure, and culture (see Volberda 1996, 1998). In general, specific organizational design parameters are expected to be related to specific flexibility types.

In the following four subsections, we set forth – as hypotheses – relationships between specific organizational characteristics and individual types of flexibility.

7.2.2.1 The Design of Technology and Operational Flexibility

Technology refers to the hardware (such as machinery and equipment) and the software (knowledge) used in the transformation of inputs into outputs, as well as the configuration of hardware and software employed by the firm (Volberda 1998, p. 124). The design of technology can range from routine to non-routine (Perrow 1967; Woodward 1965). On one hand, a routine technology, characterized by process or mass modes of production, specialized transformation means, and limited operational production repertoires, limits the potential for operational flexibility (Volberda 1998). Non-routine technology, on the other hand, is characterized by small batch or unit modes of production combined with a group layout, multipurpose means of transformation, and a large operational production repertoire. These features provide sufficient leeway for rapid changes in the volume of primary activities and the mix of products brought forward by the firm and, therefore, support operational flexibility.

Hypothesis 1: Non-routine technologies are positively related to operational flexibility.

7.2.2.2 The Organizational Structure and Structural Flexibility

The potential for structural flexibility is determined by the actual distribution of responsibilities and authorities (basic organizational structure), and also the planning and control systems and the process regulations of decision-making, coordination, and execution (Volberda 1996). To cope with market volatility and uncertainty, firms require flexible organizational boundaries (e.g., networks, joint ventures) and flat structures with basic elements of hierarchy that accommodate efficient managerial processing of information (Buckley and Casson 1998). The opportunities for structural flexibility depend on the structural design of the organization, which can be distinguished as either mechanistic or organic (Burns and Stalker 1961). Mechanistic structures are characterized by highly regulated processes and elaborate planning and control systems, specialization of tasks, and high degrees of formalization and centralization. Particularly when the type of formalization is coercive, there's little space for non-routine responses (Adler and Borys 1996). In such mechanistic structures, only minor and incremental changes are possible, thereby limiting the potential for structural flexibility. Organic structures, on the other hand, are characterized by a basic organization form that can deal with increased coordination needs between interfacing units, a rudimentary performance-oriented planning and control system that allows for ambiguous information and necessary experimentation and intuition, and limited process regulation (Van de Ven 1986; Volberda 1998). Such organic structures accommodate efficient managerial processing of information and facilitate adaptation of organizational structures and processes, which increases the potential for structural flexibility.

Hypothesis 2: Organic structures are positively related to structural flexibility.

7.2.2.3 The Organizational Culture and Strategic Flexibility

Organizational culture can be conceived of as a set of beliefs and assumptions held commonly throughout the organization and taken for granted by its members (Bate 1984) Essential features of such beliefs are that they are implicit in the minds of organization members and to some extent commonly or uniformly held (Hofstede 1980). The beliefs may constrain managerial capabilities by specifying broad, tacitly understood rules for appropriate action in unspecified contingencies (Camerer and Vepsalainen 1988). The beliefs and assumptions of the organizational culture play a central role in the interpretation of environmental stimuli and the configuration of relevant strategic responses. Does the organization see new strategic options? Can it deviate from present patterns?

The organizational culture can range from conservative to innovative, depending on the slack within the current norms and value systems for strategic capabilities. An innovative culture has a weak and heterogeneous identity with a broad scope, few unwritten rules, weak socialization processes, a high tolerance of ambiguity, and the external orientation is very open and long-term oriented (Volberda 1996, p. 364). The more innovative the culture the greater leeway for strategic flexibility within the organization. Strategic flexibility often requires changes in fundamental norms and values, which can be accomplished only within the context of broad and easily changeable idea systems (Newman et al. 1972). Furthermore, innovative cultures are open to and generate a wide range of response options, including unorthodox response options that can prove highly effective (Volberda 1998).

Hypothesis 3: Innovative cultures are positively associated with strategic flexibility.

7.2.2.4 Information Processing Routines

Aside from the adequacy of organization design characteristics, management's control capacity will also be affected by information processing routines. In rapidly changing environments, correct and timely signaling of alterations in competitive forces is of crucial importance (Volberda 1998; Teece et al. 1997). This requires constant surveillance of markets and technologies or, more broadly, environmental information processing routines. Of particular importance for strategic flexibility are information processing routines that enable the firm to identify the nature of changes in the market environment and sense opportunities that it holds (Teece et al. 2002).

Furthermore, information processing routines are required to sense the need to reconfigure the firm's asset structure and to accomplish the necessary internal and external transformation (Amit and Schoemaker 1993). Third, information processing routines are required to determine the adequate volume (number of capabilities) and composition of flexibility types (Volberda 1996). In a broader sense, the environmental information processing routines of management determine how existing flexibility is expanded and redeployed (Kogut and Zander 1992; Grant 1996) as well as how new capabilities are developed (Eisenhardt and Martin 2000).

Hypothesis 4: Information processing routines are positively associated with strategic flexibility.

7.2.3 Hierarchy of Relationships

The four hypotheses proposed above posit core determinants of organizational flexibility as taken from existing theory. We argue further, however, that these are not independent bi-variate relationships. The nature of the interrelationships between the three types of flexibility and the organization design characteristics is hierarchical, including key vertical relationships between lower-level capabilities and higher-level capabilities. Collis (1994) is particularly explicit in arguing that dynamic capabilities govern the rate of change of ordinary capabilities. Taking this logic one step further still, we will argue that second-order capabilities govern the rate of change of first-order capabilities, that third-order capabilities govern second-order capabilities, and so on.

Vertical relationships between organization design characteristics are key capabilities can be utilized efficiently only if the hierarchy of capabilities corresponds to the architecture of the firm (Grant 1996). Furthermore, the components of organizational flexibility become increasingly interdependent with the level of flexibility involved. Such upward interdependencies have been described by Sanchez (2004) as a hierarchy of competence modes and corresponding flexibility types. As the capacity of an organization to successfully create value by defining and implementing a new strategic logic depends on each of these complementary competence modes, each competence mode can act as a potential bottleneck that limits the overall competence of the organization. Specific relationships between types of flexibility are apparent.

First, structural flexibility enhances the potential for operational flexibility but foremost for strategic flexibility. When faced with revolutionary changes, management needs great internal leeway to facilitate the renewal or transformation of existing structures and processes. The link between structural flexibility and strategic flexibility is supported by the reasoning of Sanchez and Mahoney (1996) who state that by facilitating loose coupling between organizational units, modularity in organizational design can reduce the cost and difficulty of adaptive coordination, thereby increasing the strategic flexibility of firms to respond to environmental change. Ansoff and Brandenburg (1971) linked various basic organizational forms such as centralized functional forms, decentralized divisional forms, project management forms, and innovative forms to various types of flexibility. Further, concerning decision and communication processes, Dougherty and Hardy (1996) found that organizations must (re)configure their systems to facilitate sustained innovation.

A second argument relates to the association of technology and structure with strategic flexibility. Strategic flexibility is not a simple function of innovative cultures and enhanced information processing routines. Operational practices can as well significantly affect management's options to change competitive priorities (De Toni and Tonchia 2005, p. 538). Non-routine technologies can deal with the many exceptions and unstructured problems related to strategic change (Perrow 1967), give leeway for search processes (Volberda 1998), and drastically reduce life cycles in design and production stages (Meredith 1987). Grouping, or the choice of departmentalization, affects the speed of reaction as it affects the required level of coordination between firm units (Volberda 1998, p. 138). Furthermore, structure affects a firm's ability to sense new opportunities (Quinn 1985).

We define a hierarchical structure of subdimensions of organizational flexibility and argue that lower-order managerial capabilities and matching organizational design characteristics contribute to higher-order types of flexibility. An increase in operational flexibility and non-routine technology, for example, may contribute to an increase in strategic flexibility, but not necessarily as the firm may not have an incentive from its task environment to increase strategic flexibility. An increase in strategic flexibility, on the other hand, does require changes to organization design characteristics and lower-order capabilities such as technology and the operational flexibility enabled by that technology. Therefore, strategic flexibility reflects the degree of operational flexibility, but operational flexibility does not reflect strategic flexibility.

Based on the arguments above, we hypothesize that a model that takes into account the joint effects of these variables and the hierarchical nature of the constructs (see Fig. 7.1) will demonstrate a better fit with empirical data than a model based solely on individual, horizontal relations as described in Hypotheses 1–4.

Hypothesis 5: The hierarchical model of organizational flexibility will provide a better fit with the data than the non-hierarchical model.

The upper half of Fig. 7.1 presents the full conceptual specification of the nomological net of organizational flexibility proposed in this chapter, i.e., the theoretical framework. Next we develop an empirical mirror image of the theoretical framework, the observable manifestations of the variables and the interrelationships between them.

7.3 Methods and Results

7.3.1 Sample

Data was collected from a panel of organizations in the Netherlands using a structured questionnaire. The sample contains 3,259 responses from 1,904 organizations including firms in various size classes across 13 sectors of economic activity.

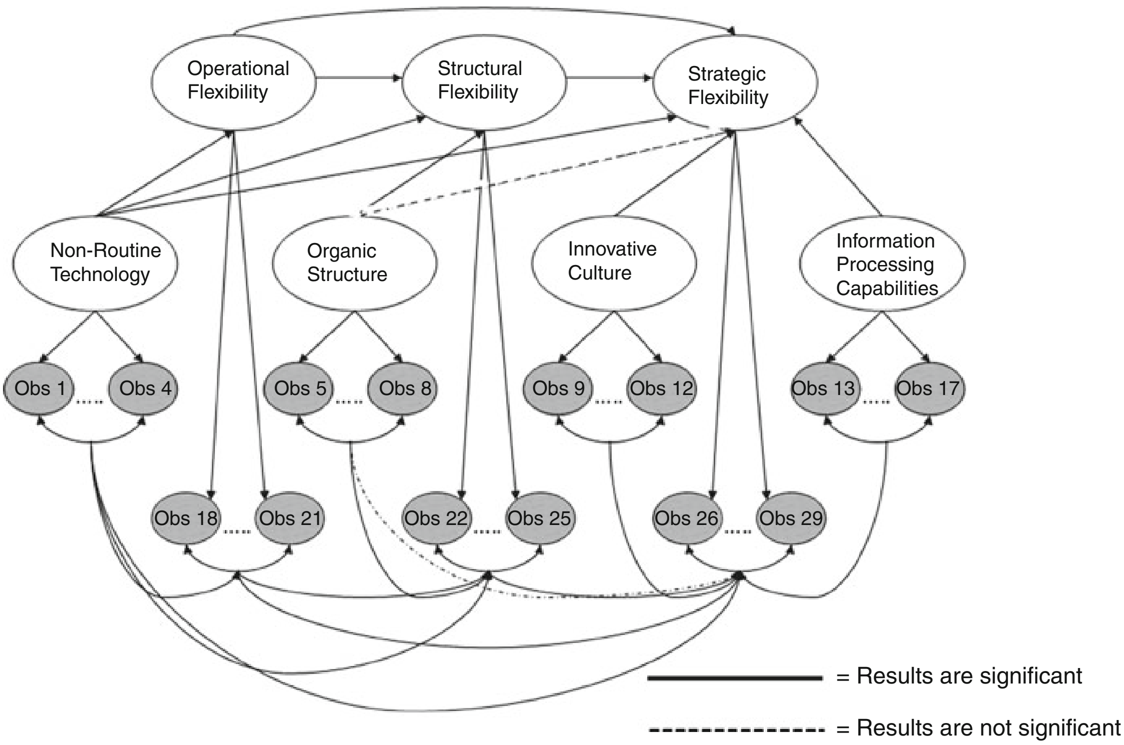

Fig. 7.1 Nomological net of organizational flexibility

Data was collected in the period 1996–2006 and respondents were executives or senior managers able to assess firm-level conditions.

To assess potential problems of single source bias, we collected multi-informant data from 133 organizations, which allowed us to examine inter-rater reliability and inter-rater agreement. Using the subset of firms for which we have multiple respondents (ranging from 5 to 34 respondents per firm), we calculated an inter-rater agreement score for each study variable (James et al. 1993). The median inter-rater agreement ranged from 0.68 to 0.80, which exceeds the generally accepted minimum of 0.60 (Glick 1985). In addition, examination of within-group reliability coefficients revealed a strong level of inter-rater reliability (Jones et al. 1983), with intra-class correlations ranging from 0.75 to 0.93 and high significance ($p < 0.001$).

Data measurement from one particular context could also be subject to context measurement effects, artifactual covariations that result from the context in which measures are obtained independent of the content of the construct under investigation (Podsakoff et al. 2003). This bias is caused by the fact that both the predictor and criterion variable are measured at the same point in time using the same medium. Several tests are available to examine whether context measurement bias distorted relationships between the variables. We first performed Harman's one-factor test on the self-reported items of the latent constructs included in our study. The hypothesis of one general factor underlying the relationships was rejected ($p < 0.01$). In addition, we found multiple factors and the first factor did not account for the majority of the variance. Second, a model fit of the measurement model of more than 0.90 (see notes Table 7.2) suggests no problems with common context bias (Bagozzi et al. 1991).

Table 7.2 Items and model variables

Constructs		Factor loadings	Item correlation w. total score
Non-routine technology (α=*0.67, composite reliability*=*0.80, average variance extracted*=*0.50*)			
Obs 1	The lay-out and set-up of our primary process can be changed easily	0.63	0.67
Obs 2	Our equipment and information systems can be used for multiple purposes	0.77	0.76
Obs 3	Our employees master several methods of production and operations	0.81	0.78
Obs 4	Our organization is up to date regarding "know-how"	0.61	0.61
Organic structure (α=*0.75, composite reliability*=*0.84, average variance extracted*=*0.58*)			
Obs 5	Our organization uses extensive and structured systems for planning and control (R)	0.72	0.72
Obs 6	In our organization, the division of work is defined in detailed descriptions of jobs and tasks (R)	0.83	0.81
Obs 7	In our organization, everything has been laid down in rules (R)	0.85	0.83
Obs 8	In our organization, there are a lot of consultation bodies (R)	0.63	0.67
Innovative culture (α=*0.70, composite reliability*=*0.82, average variance extracted*=*0.54*)			
Obs 9	For our organization goes: "The rules of our organization cannot be broken, even if someone means that it is in the company's best interest" (R)	0.68	0.72
Obs 10	Deviating opinions are not tolerated in our organization (R)	0.84	0.81
Obs 11	Creativity is highly appreciated in our organization	0.65	0.68
Obs 12	The person that introduces a less successful idea in our company can forget about his/her career (R)	0.76	0.72
Information processing routines (α=*0.70, composite reliability*=*0.81, average variance extracted*=*0.50*)			
Obs 13	In our organization, we often carry out an extensive competitor analysis	0.72	0.71
Obs 14	Competitors do not hold any secrets for us	0.70	0.61
Obs 15	In our organization, we systematically monitor technological developments concerning our products/services and the production/service process	0.72	0.73
Obs 16	Customers' needs and complaints are systematically registered in our organization	0.62	0.67
Obs 17	In our industry, we always are first to know what is going on	0.70	0.68

(continued)

Table 7.2 (continued)

Constructs		Factor loadings	Item correlation w. total score
Operational flexibility (*α = 0.66, composite reliability = 0.80, average variance extracted = 0.50*)			
Obs 18	In our organization, we can easily vary the production and/or service capacity when demand changes	0.64	0.66
Obs 19	Our organization can easily outsource activities of the primary process	0.74	0.73
Obs 20	Our organization can easily hire in temporary employees to anticipate demand fluctuations	0.75	0.74
Obs 21	Our organization can easily switch between suppliers	0.68	0.69
Structural flexibility (*α = 0.69, composite reliability = 0.81, average variance extracted = 0.52*)			
Obs 22	In our organization, tasks and functions can easily be modified	0.72	0.71
Obs 23	Our organizational structure is not fixed and can easily be modified	0.81	0.79
Obs 24	Control systems are modified often in our organization	0.62	0.63
Obs 25	People in our organization do not have a fixed position, but often carry out various jobs	0.72	0.74
Strategic flexibility (*α = 0.76, composite reliability = 0.85, average variance extracted = 0.59*)			
Obs 26	Our organization can easily add new products/services to the existing assortment	0.72	0.73
Obs 27	In our organization, we apply new technologies relatively often	0.80	0.79
Obs 28	Our organization is very active in creating new product market combinations	0.83	0.82
Obs 29	In our organization, we try to reduce risks by assuring we have products/services in different phases of their lifecycles	0.72	0.73

R = "Reversed item"
χ^2 = 455, df = 312, CFI = 0.96, RMSEA = 0.05

Third, the smallest observed correlation among the model variables can function as a proxy for common method bias (Lindell and Brandt 2000).

Table 7.3 shows an insignificant correlation value of (r = −0.01) to be the smallest correlation between the model variables, which indicates that common method bias is not a problem. Finally, we performed a partial correlation method (Podsakoff and Organ 1986). The highest factor between an unrelated set of items and each predictor variable was added to the model. These factors did not produce a significant change in variance explained, again suggesting no substantial common method bias. In sum, we conclude that the evidence from a variety of methods supports the assumption that neither common-rater bias nor common method bias account for the study's results.

Table 7.3 Descriptive statistics and pair wise correlation matrix between major variables

		Mean	Standard deviation	(1)	(2)	(3)	(4)	(5)	(6)
(1)	Non-routine technology	4.20	1.12						
(2)	Organic structure	4.29	1.30	−0.05[a]					
(3)	Innovative culture	5.40	1.10	0.26[a]	−0.27[a]	0.17[a]			
(4)	Info proc. capabilities	4.29	1.10	0.28[a]	0.25[a]				
(5)	Operational flexibility	3.74	1.23	0.27[a]	−0.03	0.15[a]	0.14[a]		
(6)	Structural flexibility	3.43	1.13	0.30[a]	−0.29[a]	0.13[a]	0.10[a]	0.29[a]	
(7)	Strategic flexibility	4.37	1.30	0.48[a]	−0.01	0.29[a]	0.45[a]	0.26[a]	0.36[a]

[a] Correlation is significant at the 0.01 level (two-tailed)

7.3.2 *Construct Measurement*

To develop the observables in the nomological net of organizational flexibility, we generated a list of items reflecting the constructs and designed a survey. The measures we used for our constructs are perceptual because perceptual measures are more appropriate for measuring managerial behavior than archival measures (Bourgeois 1980). We generated an initial list of Likert-type items based on the definitions of the constructs and by reviewing the literature that relates to these dimensions. Furthermore, exploratory interviews with management consultants and audits within various firms served as a basis for item generation and content validity assessment.

We used items related to the *technology* of the firm (see Table 7.2), which we adapted from the work of Hill (1983), Perrow (1967), and Hickson et al. (1969). Items related to *organizational structure* were adapted from Burns and Stalker (1961), Pugh et al. (1963), Lawrence and Lorsch (1967), Mintzberg (1979), and Hrebiniak and Joyce (1984). Items related to *organizational culture* were based on the work of Hofstede et al. (1990). Indicators of *information processing routines* were adapted from Hayes and Pisano (1994), Henderson and Cockburn (1994), and Grant (1996). Items reflective of *operational flexibility* were adapted from Richardson (1996) and (Kogut and Zander 1992) and items reflective of *structural flexibility* were adapted from Richardson (1996), Krijnen (1979), and Pennings and Harianto (1992). Finally, items reflective of *strategic flexibility* were adapted from Krijnen (1979), Mascarenhas (1982), Harrigan (1985), and Porter (1980).

We first investigated the psychometric properties of the scales using exploratory factor analysis on a subsample of 182 firms. We then analyzed each dimension of the scales using principal component procedures and varimax rotation to assess their unidimensionality and factor structure. Items that did not satisfy the following criteria were deleted (1) items should have communality higher than 0.3; (2) dominant loadings should be greater than 0.5; (3) cross loadings should be lower than 0.3; and (4) the scree plot criterion should be satisfied (Briggs and Cheek 1988).

The reliabilities of the dimensions of each scale were assessed by means of the Cronbach alpha coefficient. Separate dimensions achieved alphas varying between 0.66 and 0.74 (see Table 7.2). These are all variables for organizational-level constructs that are broad in conceptual scope (i.e., constructs defined by two or more distinct elements or underlying dimensions). Their reliability sufficiently exceeds the threshold level of 0.55 recommended for such constructs by Van de Ven and Ferry (1980). In addition, composite reliabilities range between 0.80 and 0.85, which is substantially above the commonly accepted threshold value of 0.70, and average variance extracted measures exceed the commonly accepted threshold value of 0.50 (Hair et al. 1998). Furthermore, all items have correlations greater than 0.50 with their respective constructs, which suggests satisfactory convergent validity of the scale items (Hulland 1999).

7.3.3 Two-Stage Structural Equation Modeling

We used two-stage structural equation modeling (SEM), to validate the measurement model and test the relationships between the observables. In the first phase, we performed confirmatory factor analysis with EQS version 6.1 to validate the scales that resulted from the exploratory factor analysis. We performed the confirmatory factor analysis on an independent sample of 1,904 firms and found a satisfactory fit for the measurement model (see notes at bottom of Table 7.2). The root-mean-squared estimated residual (RMSEA) equals 0.05 and the confirmatory factor index (CFI) equals 0.96. The CFI of 0.96 is above the threshold value of 0.90, indicating a good fit, and the RMSEA of 0.05 does not exceed the critical value of 0.08 (Bentler and Bonett 1980). We used robust estimate techniques to assess sensitivity to the normality assumption and found a satisfactory fit (CFI = 0.98, RSMEA = 0.04). We verified the discriminate validity of the scales by comparing the highest variance between any of the constructs and the variance extracted from each of the constructs (AVE) (Hair et al. 1998). In all cases, each construct's average variance extracted is larger than its correlations with other constructs. Furthermore, none of the confidence intervals between any of the constructs contained 1.0 (Anderson and Gerbing 1988). Given the variety of supporting indices, we may conclude that the measurement model is acceptable.

In the second phase of analysis, we used EQS version 6.1 to estimate the relationships between the constructs of the nomological network. The results of the estimated model are presented in Table 7.4. Because it is recommended that centered variables be used in the SEM analysis (Williams et al. 2003), we rescaled the variables into standardized *Z*-scores. We created two structural equation models: one model with non-hierarchical relationships only and one model representing the full hierarchical model. The path coefficients of both models using Normal theory maximum likelihood estimation are given in Table 7.4.

Table 7.4 SEM maximum likelihood estimates of the structural paths ($N = 3{,}216$)

	Model I Non-hierarchical path model	Model II Hierarchical path model
Model fit		
GFI (absolute fit index)	0.91	0.99
CFI (comparative fit index)	0.69	0.98
RMSEA (absolute fit index)	0.17	0.07
90% Confidence interval RMSEA	0.16< or >0.18	0.05< or >0.08
Structural paths		
Technology → Operational flexibility	0.26 (0.02)***	0.26 (0.02)***
Technology → Structural flexibility		0.23 (0.02)***
Technology → Strategic flexibility		0.27 (0.02)***
Structure → Structural flexibility	0.25 (0.02)***	0.23 (0.02)***
Structure → Strategic flexibility		–0.02 (0.01)
Culture → Strategic flexibility	0.21 (0.02)***	0.15 (0.02)***
Information processing routines → Strategic flexibility	0.45 (0.02)***	0.36 (0.02)***
Operational flexibility → Structural flexibility		0.14 (0.02)***
Operational flexibility → Strategic Flexibility		0.06 (0.01)**
Structural flexibility → Strategic flexibility		0.26 (0.02)***
	Model R-Square 0.23***	Model R-Square 0.37***

*$p<0.05$; **$p<0.01$; ***$p<0.001$

7.3.3.1 Analysis of Direct Relationships

The path coefficients from technology → operational flexibility are similar and highly significant in both the model with separate and non-hierarchical relationships and the integrated and hierarchical model ($p<0.001$). This provides support for Hypothesis 1 stating that technology is positively related to operational flexibility. The path coefficients from organic structure → structural flexibility are also similar and highly significant in both models ($p<0.001$), which supports Hypothesis 2 that organic structure is positively related to structural flexibility. The path coefficients from innovative culture → strategic flexibility and information processing routines → strategic flexibility are both substantial and highly significant ($p<0.001$), which supports Hypotheses 3 and 4.

The hypothesis tests conducted in the SEM context assume that the data used to test the model arise from a joint multivariate normal distribution. If data are not joint multivariate normal distributed, the chi-square test statistic of overall model fit will be inflated and the standard errors used to test the significance of individual parameter estimates will be deflated. We used the robust estimation procedure to correct the model fit chi-square test statistic and standard errors of individual parameter estimates (Satorra and Bentler 1988). However, comparison with the ML solution did not indicate any significant changes. In addition, Mardia's kappa test suggests no problematic kurtosis. Thus, we conclude that the non-normality of the data did not produce a problematic violation of the assumption of a joint multivariate normal distribution.

7.3.3.2 Comparison of Models

As indicated by the fit indices, both models show a sufficient absolute fit (GFI = 0.91 and GFI = 0.99). However, a fit of 0.91 indicates that the non-hierarchical model can be improved. Furthermore, absolute fit indices impose no baseline for any particular data set, and therefore can yield favorable results for a model with small relationships across measures. However, the comparative fit index (CFI) is a relative fit index adjusted for degrees of freedom and compares the model with a baseline null model, which assumes that all covariances between constructs are zero. The CFIs differ significantly between the non-hierarchical and the hierarchical model (CFI = 0.69 and CFI = 0.98, respectively). The CFI of the non-hierarchical model is insufficient, whereas the CFI of the hierarchical model indicates that further improvement of the model is unlikely. Thus, the hierarchical model demonstrates a much improved fit over the null model than does the non-hierarchical model.

The importance of this finding prompts additional verification. The result of the finding is also confirmed by the RMSEA scores of the two models. The non-hierarchical model fails to meet the minimum level for fit according to this fit index. Furthermore, the confidence interval of the non-hierarchical model is far beyond the maximum level of RMSEA (0.08), whereas the confidence interval of the hierarchical model falls comfortably below the threshold value. Finally, the total *R*-square of the hierarchical model (0.37) is substantially higher than the *R*-square of the non-hierarchical model (0.23). The hierarchical model accounts for about 37% of the variance in strategic flexibility, which can be considered substantial considering the perceptual nature of the data. All added hierarchical relations are significant, except the path coefficient between structure and strategic flexibility. This suggests that the impact of organizational structure on strategic flexibility is fully mediated by structural flexibility and that no significant direct relationship between structure and strategic flexibility exists. We conclude that the hierarchical model provides a much better fit with the data than the non-hierarchical model, which supports Hypothesis 5.

We conducted sensitivity analyses for our results by estimating structural equation models that included industry dummies and firm size as control variables. The model as presented in Table 7.4 and the above results were robust to the inclusion of these controls. In addition, we tested the model while removing the direct relationship between organic structure and strategic flexibility. Removing this relationship slightly improved model fit (CFI = 0.99; RSMEA 0.03). Finally, we conducted a Lagrange multiplier test on this respecified model and found that no alternative specification of the parameters would lead to a model that better represents the data.

7.4 Discussion

Despite a wealth of conceptual articles dealing with the multidimensional aspects of organizational flexibility, the number of empirical studies investigating such multidimensionality is limited (Dreyer and Grønhaug 2004). In this chapter, we develop a nomological net of organizational flexibility and present measures of various constructs as well as a theoretical model specifying the relationships between these constructs. In this chapter, we develop and test as a model a hierarchical structure of subdimensions of organizational flexibility and find that lower-order dynamic capabilities and matching organizational design characteristics contribute to higher-order dynamic capabilities and organizational flexibility. This hierarchical and multi-dimensional model demonstrates a strong fit with the empirical data of a large sample of firms.

7.4.1 Implications for Organization Design Theory

Having validated core propositions regarding organizational flexibility and a nomological net in which multiple perspectives are analyzed simultaneously, subsequent studies may advance theory in several respects. First, our model enables researchers to distinguish the effects of various dimensions of environmental turbulence, such as the level of market dynamism and the level of market unpredictability, in relation to different types of flexibility. Volberda (1996, 1998) theorized about the discriminate effects between dimensions of environmental turbulence and different types of flexibility. Empirical testing of such propositions comes within reach with the model developed in this chapter.

Second, the model developed in this chapter enables analysis of the criteria used by successful firms regarding appropriate strategies and their organizational design. It remains unclear whether firms strive to benefit by continuously adjusting managerial capabilities and organizational design variables to changes in the task environment, as contingency theory holds (Donaldson 2001; Venkatraman 1989), or whether firms actually conform to the institutional pressures of the business environment, as propagated by institutional theorists (Scott 2001; Zucker 1987).

With respect to the study of collaborative communities of firms, our framework enables the analysis of the organizational design characteristics of firms operating in such communities. Joining and participating in a collaborative community with other firms is a manifestation of organizational flexibility and has implications for the level of environmental turbulence, as the individual firm has less control over the processes that are externalized. Our framework may be used to predict the specific characteristics of successful firms in more or less dynamic collaborative communities.

7.4.2 Implications for Organization Design Practice

The notion of a hierarchical structure of dynamic capabilities and the associations of different types of flexibility with organizational design variables may increase the effectiveness of managerial interventions in at least two ways.

First, such a notion supports the managerial application of the principle of minimum intervention. The principle of minimum intervention contends that managers attempt to implement strategy within the constraints of economic efficiency, choosing courses of action that solve their problems with minimum costs to the organization (Hrebiniak and Joyce 1984). As the scope of interventions increases, i.e., when more higher-order capabilities and more tacit organizational variables are subject to a change process, not only do the costs increase but so do the risks of unintended consequences.

Second, the comprehensive model presented here facilitates the coordination of change efforts across the different functions and hierarchical layers of the organization. Our model clarifies the link between operational capabilities and strategic capabilities and elaborates the function of organizational design variables with respect to creating organizational flexibility. Most importantly, managers can use our hierarchical model to help coordinate change efforts across the organization, ensuring that operational and strategic levels are aligned and that both tangible (technology) and intangible (cultural) aspects of the organization are accounted for.

7.4.3 Limitations

While this study demonstrates considerable support for our conception of organizational flexibility, we must address a few limitations. Although our study includes a wide variety of firms, all were active in one particular country, The Netherlands. This may have biased the results as organizational flexibility may be partly dependent on institutional and cultural factors. Furthermore, this study did not control for multilevel industry effects. Such variables may also moderate the relationships proposed in this study or affect the impact of some variables on organizational flexibility as an outcome. Future studies might control for these limitations to further nuance the results presented here.

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